Coastal news

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Contents

Hindcasting and Forecasting Ocean Conditions around New Zealand

Drs David Johnson, Peter McComb and Brett Beamsley of MetOcean Solutions Ltd (www.metocean.co.nz) *discuss the benefits of a newly available, low cost and yet high-resolution wind, wave, tide and current hindcasting and forecasting tool for all of New Zealand.*

Coastal process management has long benefited from knowledge of the ocean conditions - particularly in the fields of development planning, infrastructure design and hazard management. Prevailing and extreme wave, swell, tidal and storm surge conditions are a key set of drivers for decisions in these fields. Historically, much of the readily available data has been of a short temporal duration or low spatial resolution, or required to be commissioned from consultants on a project-by-project basis. Even though the quality and quantity of ocean data has improved significantly over time, the coastal manager or engineer is still constrained by available data in their decision making process. However, obtaining location specific ocean data does not necessarily require costly consulting assignments involving instrument deployments. Advanced modelling and the accessibility of computer processing power have allowed MSL to develop a regional metocean hindcast / forecast system, providing high-resolution ocean data for any location within New Zealand waters.

New Zealand is a unique location in many respects. The ocean dominates our temperate climate, and NZ straddles the zone between the sub-Tropic and the sub-Antarctic. The mountainous topography causes high spatial variability in the wind fields, and the coastal complexity leads to strong gradients in wave energy. The west coast is subject to persistent long period swells, while the northeast coast is typically calm yet sometimes experiences the effects of tropical cyclones. The wave climate is highly dynamic and changeable and at times New Zealand experiences extreme sea states. There is a tidal amphidrome in Cook Strait, and the tidal current regime varies considerably from

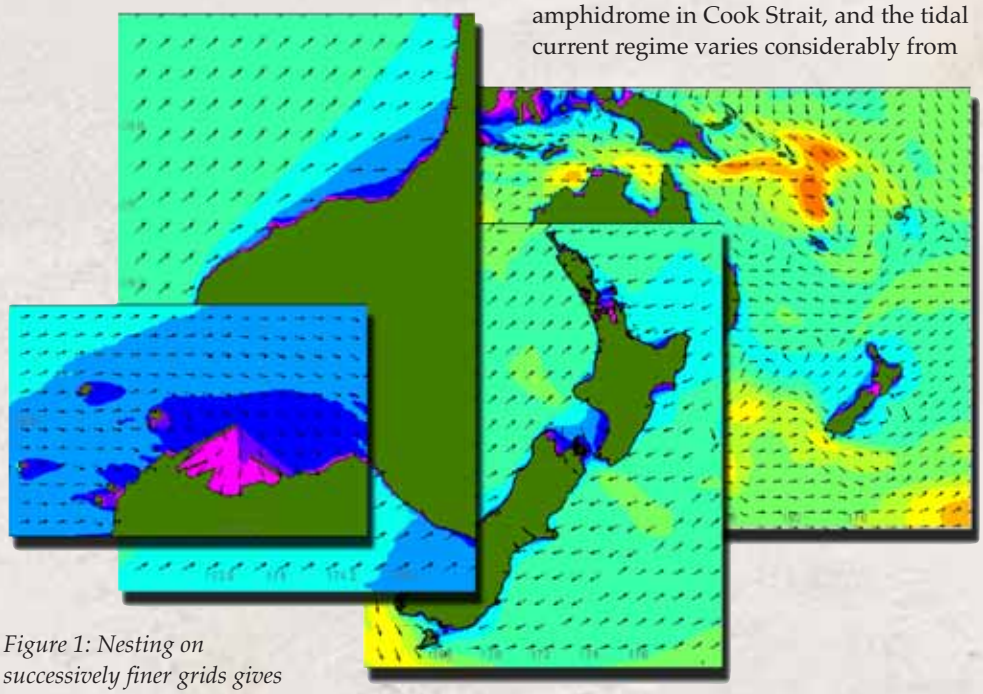

Figure 1: Nesting on successively finer grids gives detailed resolution of ocean conditions near the coast in areas of interest.

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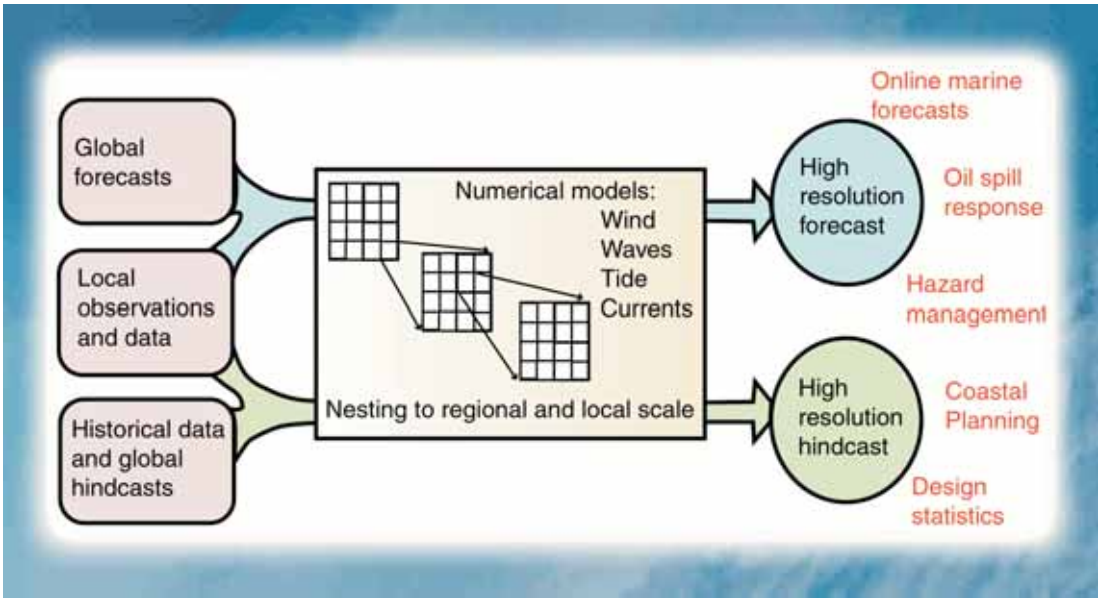


Figure 2: The forecast/hindcast system generates high-resolution regional and local information.

location to location. Oceanic and coastal currents are forced by the wind, steered by complex bathymetry and modified by geostrophy.

To deal with this complexity, the MSL system runs numerical models on a series of nested numerical domains. This allows the ocean processes to be resolved at increasingly smaller scales until the local features in areas of interest are properly represented, while ensuring that accurate boundary conditions apply at each stage. MSL utilises state-of the–art open source models that have been developed within the general academic community[1], and the open availability of these models ensures transparency in terms of the scientific methods used. The models have been tested, validated and used operationally in numerous other locations, and MSL carries out independent validation for the New Zealand implementations.

The MetOcean models have been validated against numerous measurements around NZ

Historical and forecast boundary conditions are obtained from global model solutions and measured satellite data. MSL has created an infrastructure in which the models are integrated and data post-processed to provide the end user with easily utilised data products for engineering design, environmental planning, hazard management and even marine based recreation.

It is now economical for national, regional and even multi-location local hindcasts to be run effectively en masse and the data stored offline – such as by DVD – for the immediate use by coastal planners, engineers, students and researchers for a variety of applications. What's more, data can be made available in user-friendly formats such as GIS and integrated with topographical maps. Relatively routine or low profile coastal planning or hazard management decisions can be supported by immediate access to high quality, local data.

MetOcean forecasts of the waves, winds and currents are generated twice per day, and provide hourly data up to 7 days ahead.

In addition to pre-processed hindcast data, MSL provides an on-line, web based forecast system providing wind and wave forecasts for specific locations around the New Zealand coastline 7 days out. Already in use by commercial users, such as ports and oil companies, as well as recreational uses (www.swellmap.com), the forecasting system models location specific wind, wave, tide, surge conditions and current flows. By providing all the important forecast information in one place, it greatly facilitates pro-active hazard management. Specifically, the model provides the complex inputs needed for applications such as oil spill trajectory simulations, search and rescue, beach safety, and coastal erosion / overtopping warnings.

As an example of how the MSL system has been applied, the wave climate at the entrance to Port Taranaki has been hindcast at spatial scales of 25 m, characterising wave transformation in varying sea states over the tidal cycles and allowing operational parameters for the shipping channel to be studied in detail. In forecast mode, the system runs on a 12-hourly cycle to provide forecasts of wave spectra along the shipping channel and long wave surging within the harbour

An hourly hindcast time-series of the waves, winds, tides and currents is available for any location in NZ for an 8 year period (June 1997 to date). The data hindcast period will extend to 25 years by late 2006.

[1] Ocean waves are simulated using SWAN. Currents and tidal elevations are simulated using an implementation of the Princeton Ocean Model (POM) and wind flows are modelled with MM5.

7 days ahead, and the data are used to calculate under keel clearance and assist planning of marine operations.

Advances in wind, wave and current modelling, combined with the growth of oceanographic knowledge and computing power, are creating a new paradigm in the quantity, detail and accuracy of information that is available without the need for costly instrument deployments. MSL are working to maximise the potential of these advances and deliver high quality, high resolution and easy to understand information about oceanic conditions to the finger-tips of professionals who actively manage and work in our coastal and oceanic environment.

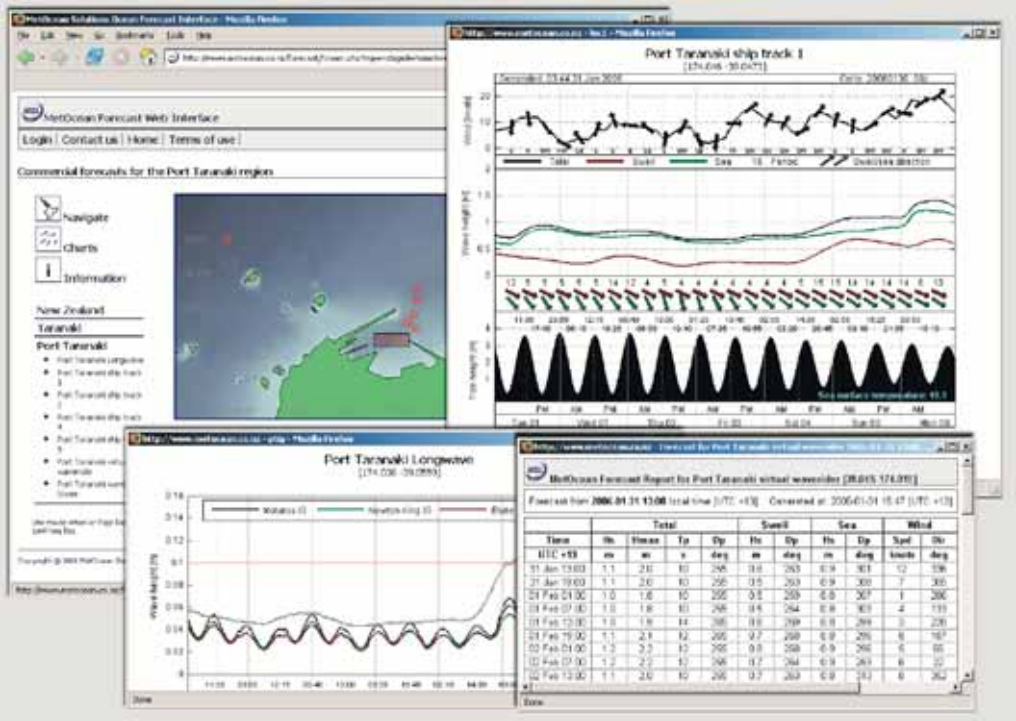


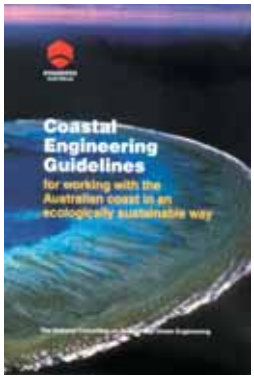
Figure 3: Forecasts are available to marine operators through an on-line web interface.

New Engineering Guidelines

The National Committee on Coastal and Ocean Engineering has recently published two texts, titled *Guidelines For Responding To The Effects Of Climate Change In Coastal And Ocean Engineering* - 2004 update and *Coastal Engineering Guidelines For Working With The Australian Coast In An Ecologically Sustainable Way.*

The 75-page climate change text provides a background to the scientific debate on the causes of atmospheric warming due to the enhanced greenhouse effect and identifies the primary climate sensitive factors for various types of coastal engineering activities.

It summarises the scenarios provided by the Intergovernmental Panel on Climate Change and outlines how this may be interpreted for the Australian coastline and ocean. It further makes recommendations on how the information can be incorporated into engineering design, demonstrating the principles by example.



The 128-page coastal guidelines text is a more general work aimed at spanning the gamut of coastal and ocean engineering activities in Australia.

The chapter headings give an indication of the report's depth and coverage and include coastal zone policy, ethics, responsibilities and the duty of care, coastal environment, coastal development, coastal engineering methodology, standards, codes and quality assurance.

As well, there are supplements on beach replenishment, marinas, outfalls and construction materials for the marine environment.

Both these books can be ordered from EA Books for $22 each (GST included):

www.engaust.com.au/bookshop/location.asp

Courtesy of Engineers Media, Civil Engineers Australia, October 2005 edition, p50.

Managing the Impacts of Living on the Coast through Triple Bottom Line Assessments

Buffalo Beach and Cooks Beach, both located on the east coast of the Coromandel Peninsula, have suffered from varying levels of coastal erosion hazard since the areas were developed during the late 1800s. Existing information on coastal processes of the two beaches suggests that erosion is primarily related to dynamic shoreline fluctuations rather than permanent shoreline retreat. However, past developments involved the levelling of dunes and construction of infrastructure and properties too close to the shore, resulting in a coastal hazard during periods of erosion. To date, the primary response of the road managers and private property owners to coastal erosion at both beaches has been the placement of various seawall structures. This ad hoc response to erosion hazard detracts from the vision of an ideal coastal community and environment.

Environment Waikato and the Thames-Coromandel District Council are jointly addressing the coastal hazard issue at Buffalo Beach, Cooks Beach and other Coromandel beaches by planning for erosion management over a 25-50 year timescale. The two councils commissioned a Beca led team (with Eco Nomos Ltd and Covec as subconsultants) to identify issues and options at Buffalo and Cooks Beach and select the most technically feasible, cost effective and sustainable option. The study was conducted as a pilot so that lessons learned could be extrapolated to the wider Waikato Region. The project team consisted of coastal planners, engineers, scientists and environmental economists.

The preferred erosion management options for each beach were determined by considering the economic, social, cultural and environmental issues to achieve triple bottom line outcomes for the long-term sustainable development of the beaches. In order to be able to assess the various management options, a draft strategy vision and objectives were developed to identify desired outcomes for each beach over the next 50 years. The draft vision and objectives were developed so that they could be further canvassed with the community and stakeholders to provide a common direction for coastal erosion management of Buffalo and Cooks Beach in the future.

Various options ranging from status quo (do nothing) through to hard engineering options such as offshore breakwaters were assessed. Potential options were screened for any 'fatal flaws' that made some options technically unfeasible. A Cost-Benefit-Analysis (CBA) and Multi-Criteria-Analysis (MCA) were then undertaken to estimate the costs and benefits of proposed management options for coastal erosion.

The CBA evaluated the options in terms of the impacts on beachfront dwellers and the wider community. The costs and benefits included capital and maintenance costs, property loss and house relocation costs. Intangibles such as naturalness loss and gain were also valued, including natural character, aesthetics, public access and recreational activities. The intangibles were evaluated using existing New Zealand evaluation studies.

The MCA was a qualitative analysis that involved developing a matrix to assess various environmental, social and economic indicators. Indicators were graded for the type of impact (either positive or negative or both) and the level of this impact (either low, medium or high). Indicators included matters of national importance in the RMA (e.g. public access, historic heritage, natural character, etc), matters considered important for beachfront property owners (e.g. protection of private property, private capital, etc) and values that may be important to the wider community (e.g. beach amenity). MCA is a useful tool, which facilitates consultation with the community, allowing the community to attach different weightings to identified impacts according to their own values and preferences.

The study found that a backstop wall was the option most likely to achieve the vision for Cooks Beach (i.e. was the option that had the most positive and the least negative impacts in the qualitative assessment and the highest economic benefit over 50 years).

Photo 1: Seawall at Buffalo Beach, Whitianga. (Photo courtesy of Beca.)

Photo 2: Erosion prevention at Cooks Beach. (Photo courtesy of Beca.)

Different options were preferred for different sections of Buffalo Beach depending on the existing level of development. Three options scored highly for the developed southern end of Buffalo Beach (nearest Whitianga town centre): a groyne and beach nourishment programme; a frontal seawall plus rezoning beachfront land to town centre (commercial); and realigning a frontal seawall landward and reducing the road to one lane. The preferred option for the undeveloped mid section of Buffalo Beach is dune restoration, which scored similarly to status quo in the qualitative assessment but has a greater economic benefit for society as a whole in the longer term. The preferred option for the developed northern end of Buffalo Beach was to relocate dwellings back from the shore and redevelop with a backstop wall.

Environment Waikato and the Thames Coromandel District Council are now about to consult with the community and key stakeholders to further refine the coastal erosion management strategies for the two beaches.

Cushla Loomb, Senior Planner,
Beca Planning
cushla.loomb@beca.com

Coastal Engineering Award goes to New Zealanders

The premier Australasian award for a paper in coastal engineering, the Kevin Stark Memorial Award, has been won by Craig Stevens, David Phew, Stephanie Popinet and David Fredriksson for their paper "Mussel farm hydrodynamics". Stevens and Popinet are from the National Institute for Water and Atmospheric Research. Plew is from the Department of Civil Engineering at the University of Canterbury. Fredriksson is from the department of Ocean Engineering, University of New Hampshire, USA.

This paper discussed flow around shellfish farms at a range of scales from individual shells to whole aquaculture embayments. The study used sophisticated dynamic models and field data to arrive at significant conclusions regarding the supply of nutrients to the shellfish and the removal of their wastes.

The Kevin Stark Award, and other awards, were made at last month's Australasian Coasts and Ports Conference in Adelaide.

Courtesy of Engineers Media, Civil Engineers Australia, October 2005 edition, p50.

Seeking Contributions to *Coastal News*

Your contributions to Coastal News are welcome. These contributions are important to keep NZCS members informed about coastal issues in New Zealand and around the world. Contributions may be in the form of advertisements, notification about conferences or workshops, short news items, or longer articles of 400-800 words plus photos or diagrams.

For further information or to submit an idea please contact Alex Eagles, Editor *Coastal News*, on penguins@clear.net.nz.

Tsunamis in the Auckland region: Where? How big? How often?

Coastal News

In the wake of the 26 December 2004 Indian Ocean tsunami we have seen an increased awareness of tsunamis, and with this has come the need to learn more about them.

The coastal margins of the Auckland region are highly developed. It is therefore not surprising that the Auckland Regional Council wanted an update of what was known about tsunamis affecting their region. More specifically, they wanted to get a feel for what we know, what we need to know, and what we can deduce from the information available to us.

Tsunami deposits in Whangapoua Harbour, Great Barrier Island (photo: Scott Nichol)

It is all too easy in these circumstances to resort to a simple desktop study. We have seen many of these in the past. Go to the library, carry out a quick literature review, combine this with what you know already, and come up with a story. Given recent events in the Indian Ocean, however, this was simply not enough. We need to move forward and confront the issue of tsunami hazard and risk head on.

The development of a study that summarises the tsunami hazard requires some thought. What do we really need to know? It follows a logical pathway:

1. What are the potential tsunami sources for the Auckland region?
2. What is the record of past events – historic and prehistoric?
3. What can we say about the magnitude and frequency of these events – and from which source?
4. What are the most likely damaging sources?
5. As an indication of what this information means to the region, what is a tsunami likely to do in and around the Hauraki Gulf?
6. What information is missing?
7. Where do we go from here?

The pathway, however, does not simply go from 1 to 7. It is an iterative process. We developed a list of potential tsunami sources and cross-checked this against the historic and then the prehistoric data. One of the most compelling findings of this simple exercise is the power of the prehistoric record to change opinions.

A look at the historic information first indicates that Chile has been the main source of reasonably large tsunamis over the last 130 years or so, and in 1868 a South American tsunami ran up nearly 3.00 m on Great Barrier Island. There is a hint in the historical record, though, that Indonesia or northern and northwestern sources may be a concern, with a 1.80 m tsunami recorded as a result of the Krakatoa eruption in 1883.

Important advances have been made with studies of the geological record of prehistoric tsunamis. As many as 33 sites have been identified in the northern part of the North Island, of which 9 are in the Auckland region and 5 have been studied in detail. The most significant events occurred around the late 14th and early 15th centuries (max. run-up to 14 m and under 10 m respectively). The extensive record of coastal sites has allowed us to integrate geological data with numerical models to identify potential sources. This has allowed us to identify new sources and differentiate between a suite of known ones.

Putting all these data together, we have produced magnitude, frequency, and source estimates indicating that large tsunamis (greater than 5 m) have a frequency of once every 900 years or so, and that they will most likely be sourced either locally (outside the Hauraki Gulf) in association with the Tonga–Kermadec Trench–Hikurangi Trough, or possibly distantly from the north.

The figure shows a numerical model of a tsunami approaching from the east, indicating that the highest waves will strike the eastern shores of Great Barrier Island. Once inside Hauraki Gulf, the tsunami propagates down the coast towards Auckland with diminishing height, with a large reflected wave arriving at Waiheke Island at about the same time as the tsunami enters Waitemata Harbour.

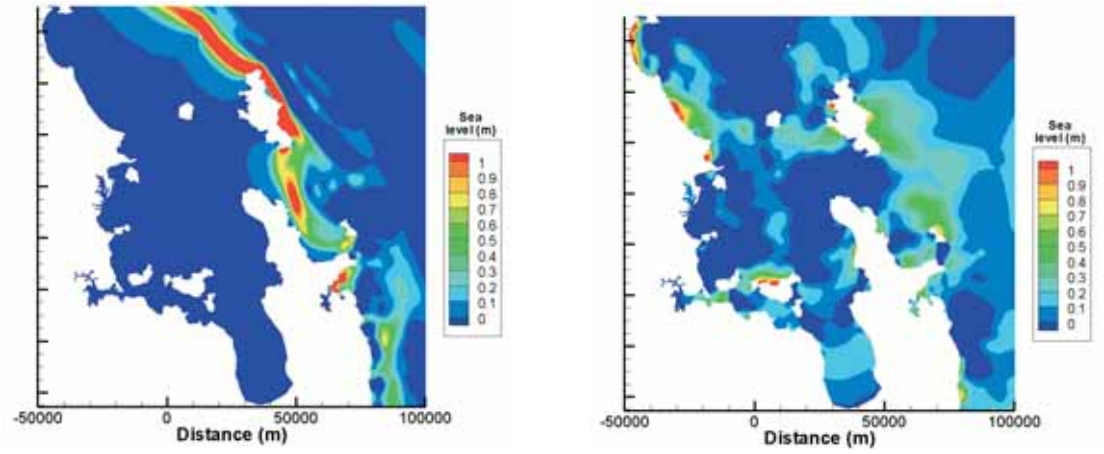
There are many pieces of the jigsaw missing, but the study has served to focus attention on several key areas for further work. The need to understand tsunami inundation in key coastal areas is the driver. An increasing database of geological evidence alongside detailed bathymetry and LIDAR data provides a more detailed and

comprehensive data base for model input. This approach of integrating geological groundtruthing and numerical modelling is producing models that can now accurately and realistically predict inundation. It is encouraging to see that such an integrated approach has also been recognised in the US. Just before Christmas, the US National Science and Technology Council issued a report entitled "Tsunami Risk Reduction for the United States: A Framework for Action". It states: "Field surveys are needed to identify past tsunami impacts for specific locations and to characterize potential tsunami sources including offshore faults, submarine landslides and island volcanoes. Geological studies including stratigraphic analyses of prehistoric tsunami deposits to determine past tsunami frequency and size, as well as comprehensive documentation of the coastal impacts of modern tsunamis are needed. Improved models of tsunami run up and flooding are needed to determine tsunami impacts and to develop effective countermeasures."

We agree. This is exactly what we are doing.

James Goff & Roy Walters, NIWA
j.goff@niwa.co.nz
r.walters@niwa.co.nz

Jane Olsen
Auckland Regional Council
jane.olsen@arc.govt.nz



Tsunami wave from the east striking Great Barrier Island (left) and reflecting from Waiheke Island (right).

Coastal News

Development of coastal hazard risk indicators for the Bay of Plenty Region

Why the need for coastal hazard risk indicators?

Just over 74 % of the Bay of Plenty (BOP) coastline is soft sandy coast and like most open sandy coasts in New Zealand, the BOP is not alone in being vulnerable to coastal hazards. The coastal hazard risk is a major issue in the BOP region because of the close proximity of development to the coast at a number of coastal communities. The coastal hazard risk has been further compounded by the recent increasing desire for people to live at the coast. This has resulted in a change from the modest low cost kiwi holiday bach to permanent high quality residences.

Environment Bay of Plenty (EBOP) has an Operative Regional Coastal Environment Plan (RCEP) that sets out the coastal hazard management framework. The coastal hazards chapter of the plan has the following objective: "No increase in the total physical risk from coastal hazards". The key policy that gives effect to this objective is the identification of Areas Sensitive to Coastal Hazards (ASCH). EBOP has identified ASCH for the entire open coast in the region and this information has been printed on regional coastal plan maps. The purpose of the ASCH is to define areas of open coast where caution should be exercised when city and district councils consider subdivision and development proposals.

The plan advocates that relevant city and district councils commission research to identify coastal hazard zones or areas according to standard criteria set out in the RCEP. The plan does not advocate any particular methodology as long as the criteria are met and the methodology is scientifically defensible. The methodologies generally only address the coastal erosion hazard as the RCEP criteria does not address inundation hazards to the open coast which is managed separately. To date four different methodologies have been used to identify coastal hazards. This has resulted in some regional inconsistencies and difficulties when making comparative analysis of information from the four coastal city and district councils in the region.

Figure 1: Coastal development along Papamoa beach – Bay of Plenty

Policy implementation methods contained in the plan require EBOP to carry out monitoring of the active beach system, and changes in the intensity of subdivision and structural development in coastal hazard areas. EBOP has an extensive beach profile monitoring programme of 56 sites to measure the changes on the active beach system or the "wet side" of the coastal environment. This monitoring program has been in place since 1990.

However, since the RCEP became fully operative in 2003, EBOP did not have monitoring tools to measure changes in the intensity of subdivision and development in known coastal hazard areas and overarching monitoring of the plan objective. Therefore, a project was established to develop monitoring tools to address the plan objective monitoring requirements.

Figure 2: Modern beachfront properties in the Bay of Plenty and old style batches

A commonly accepted method to measure change is to use indicators and this was considered the best approach for measuring changes in development in coastal hazard areas. The Ministry for the Environment (MfE) is establishing a set of environmental indicators as part of the NZ Environmental Performance Indicators Programme for state of the environment

Figure 3: Bay of Plenty Regional Coastal Environment Plan

reporting (MfE, 1998). The MfE indicators are mainly physical process based and no indicators have been developed that measure coastal hazards or risks. Therefore, EBOP commissioned planning consultants Hill Young Cooper Ltd and technical coastal consultant Jim Dahm (Eco Nomos), with guidance from EBOP staff, to develop indicators to measure changes coastal hazard risk.

What approach was used for indicator development?

The project team explored the concept of total physical risk during the indicator development process and it was reported that total risk includes both the coastal processes (the forces acting) and the activity impacted (area acted on). This is represented by the conceptual equation A + B = TPR; where A = change in coastal processes ; B = change in the level and management of subdivision and development of private and public land (including roads and open space); and TPR = change in total physical risk.

The focus of the project is on the landward side of the coastal environment which is the area impacted or acted on by coastal hazards. The indicators are needed to address that part of the equation represented by "B".

After a review of experiences from NZ and around the world the project team formulated indicators and these were reported to EBOP in October 2003. The proposed indicators are subdivided into categories to show baseline risk information as well as changes in risk. The first level indicators are the foundation that are the "building blocks" for risk management and are yes/no descriptive indicators, i.e. have coastal hazard zones been identified and included on district planning maps. Data for the foundation indicators could be obtained by reviewing the relevant provisions in district plans.

The second level of indicators provides a basis for understanding change over time but did required baseline information first. These indicators were termed the "baseline" indicators e.g. Average building set back for residential dwellings in the "primary" hazard zone from the toe of the foredune. Information for these indicators was derived from analysis of cadastral information on EBOP GIS system and from aerial photography GIS databases. However, methods for compiling and analysing the data still needed to be developed prior to implementation.

The third level are termed "trend" indicators which focus on measuring changes in the management of physical risk by using district council resource consent approvals and activates in coastal hazards areas generally requiring resource consents e.g. Number of land use consents granted in coastal hazard zones with relocation or setback conditions for residential

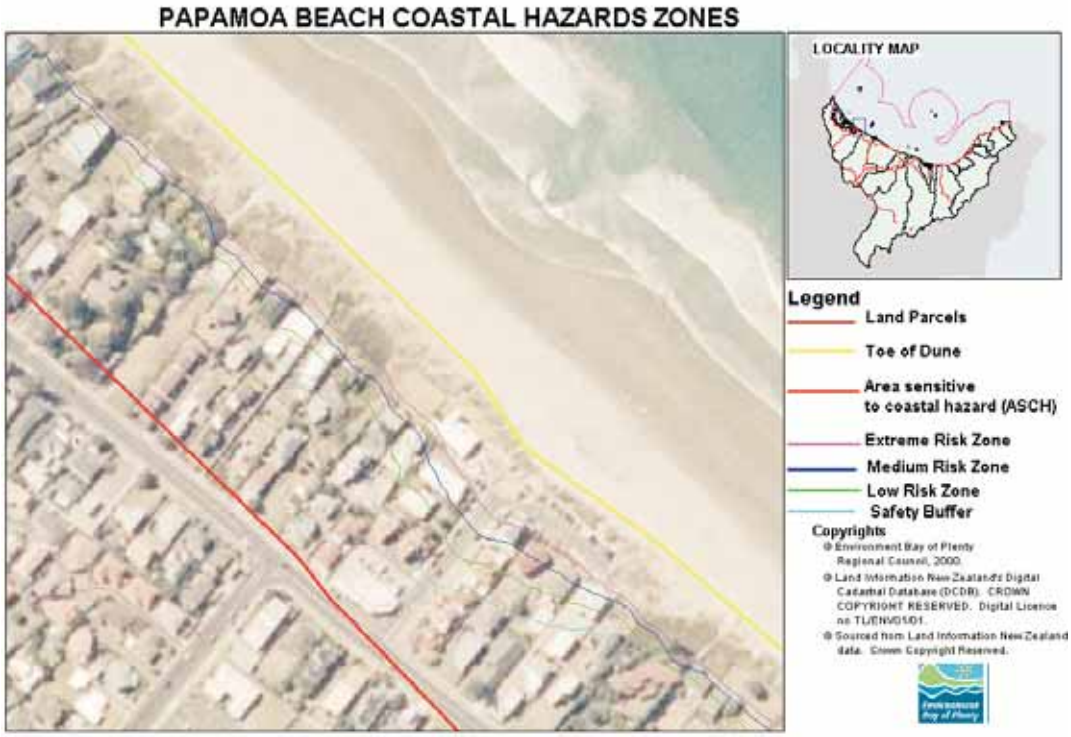


Figure 1.4 Example of mapped coastal hazard assessments at Papamoa Beach Bay of Plenty.

Figure 1.5 Setback measurements for beachfront lots (1:7500 aerial photo: Ohope Beach)

dwellings. The project team then sort input comments on the indicators from the coastal city and district councils. This was an important process as some of the data needed for the indicators would be collected from city and district councils. Consultation also helped to identify potential issues with the proposed set of indicators.

Can the proposed indicators be practically implemented?

In order to test if the proposed indicators could be practically implemented a trial was conducted in 2004 at the 12 coastal communities in the region that are considered to be at risk from coastal hazards. The results of the trail have been published in an EBOP report: "Pilot Report of Proposed Coastal Hazard Indicators", Environmental Publication 2005/21. Copies of the report can be downloaded from www.envbop.govt.nz.

The trial found that the proposed foundation indicators were relatively easy to implement as the data could be easily compiled by simply reviewing the relevant provisions in district plans. Therefore, it was recommended that the foundation indicators could be implemented in their present form:

F1 Have coastal hazard zones been identified and included on district planning maps?

F2 Are there district rules to support those hazard zones and are these aimed at not increasing physical risk of coastal hazards (in some areas this will include "no-subdivision rules" and large building setbacks/ coastal reserves)?

F3 Are there administrative or district plan policies to ensure that any building within the coastal hazard zones is subject to controls to mitigate risk such as relocatability and relocation plans?

All of the baseline indicators trialled required methodologies to be developed so that data collected from the GIS analysis of cadastral and aerial photography could be collected consistently and to enable a meaningful regional overview to be established. However, it was also found that the variation in coastal hazard zone methodologies used by the different city and district councils in the region made it difficult to formulate a comparative baseline. This was overcome by resolving all the hazards areas/zones used in the region into a single nomenclature by considering common components of each of the hazard zones analysis used across the region.

Coastal Community	City or District Council	"Primary" Hazard Zone	"Secondary" Hazard Zone	Totals
Waihi Beach	Western BOP District	112	201	**313**
Pukehina Beach	Western BOP District	261	87	**348**
Mt Maunganui Beach	Tauranga City	54	14	**68**
Papamoa Beach	Tauranga City	128	4	**132**
Piripai Beach	Whakatane District	5	0	**5**
Ohope Beach	Whakatane District	74	125	**199**
Bay of Plenty Areas of Concern		**634**	**431**	**1065**

Figure 1.6: Number of residential lots in the primary and secondary risk zones for coastal communities in the Bay of Plenty.

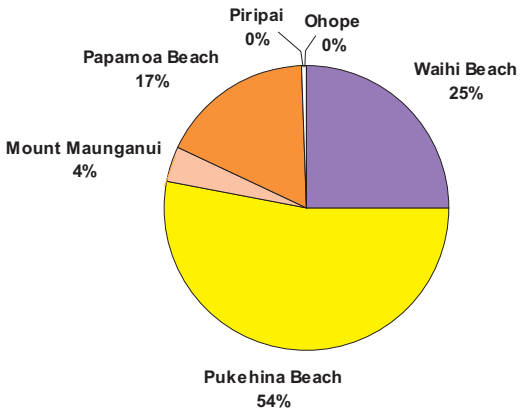


Figure 1.7: Percentage of residential dwellings in the "Primary hazard zone" for coastal communities with identified coastal hazard zones in the Bay of Plenty Region.

The following baseline indicators were considered suitable for implementation:

B1 Average building set back for residential dwellings in the "primary" hazard zone from the toe of the foredune.

B2 Number of residential dwellings in the "primary" and "secondary" hazard zones at the date of the most recent aerial photography.

B3 Number of residential lots in the "primary" and "secondary" hazard zones from the DCDB at a date close to the aerial photography date.

It was also found that the suitability of trend indicators could not be assessed until the collection of a second set of data. However, it was found that the successful implementation of the trend indicators would require an efficient process of collating resource consent information. This could be achieved by setting up a specific information sharing protocol with city and district councils so that information is collated in a systematic and consistent manner to enable defensible meaningful analysis of the data.

What did the indicator results tell us about the management of the coastal erosion hazard risk in the region and is the coastal plan objective being achieved?

The indicator results for the region found that there has been progress towards managing coastal erosion hazard risk. However, only two of the four city and district councils in the region have identified coastal hazards zones in their district plans. This means that only four of the 12 coastal communities have policy and rules to manage coastal erosion hazard. The four coastal communities (Waihi, Pukehina, Mt Maunganui and Papamoa) that have district plan hazard management provisions are the communities where there is currently the most intensive pressure for coastal development.

It was found that Waihi and Pukehina beach communities have the greatest number of residential land parcels at risk from coastal erosion hazards. These communities were also found to have the greatest number of residential dwellings in the primary risk area and the shortest average setback distance from the toe of the foredune. These communities have district plan management controls in place. However, the collation of a second set of trend indicator information is now needed to determine if risk is being managed sufficiently to achieve the RCEPobjective of "No increase in the total physical risk from coastal hazards".

The next stage of the project is to finalise the indicators for implementation and explore the possibility of an indicator index so that changes in the management of risk can be more easily quantified, and to an index to incorporate the physical coastal processes.

What lessons have been learnt from the coastal hazard indicator trial and our experience with regional coastal plan coastal hazard management policy frame work?

As result of the indicator development process it was found that the range of hazard analysis methods used by the region's district councils has resulted in some regional inconsistency, which has made it difficult to assemble sensible comparative hazard indicator data for the region. This is particularly apparent when hazard zones are divided according to the level of risk. However, the flexible approach of the RCEP criteria has provided for differences in the physical environments and planning contexts across the region. Secondly, the development of coastal hazard methodologies has been an emerging new science that is only now starting to grapple with realities of resource management planning. This highlights the need for close collaboration of the science of hazard zone analysis and hazard management policy-making to ensure the policy can be coupled with hazard zone methodology that is consistent with the realities of physical and planning environments.

In terms of hazard management planning controls, it is clear from our experience, that the multi-zone approach can be advantageous when considering coastal hazard risk in existing areas of development.

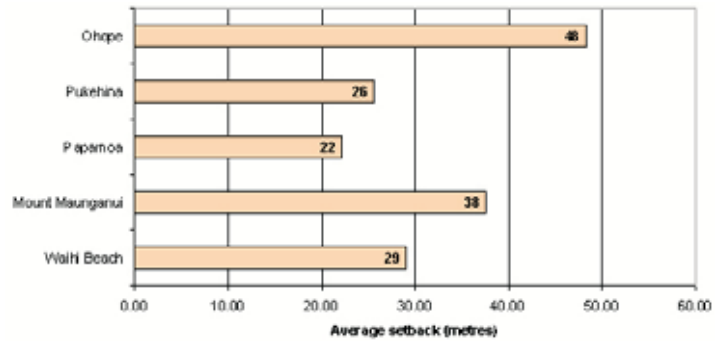


Figure 1.8 Average building setbacks for coastal communities with identified coastal hazard zones in the Bay of Plenty Region.

This is because specific planning controls can be tailored to manage the level of risk. It was found that hazard management planning provisions are a delicate balance between reasonable use of land as a property right and the management of coastal hazard risk, and many of the management provisions such as relocation conditions on resource consents are as yet untested.

It was also found that existing use right provisions of section 10 of the RMA at the territorial authority planning level tend to hinder achieving the RCEP hazard management objective. However, the introduction of coast care programmes in the BOP has not only helped to stabilise and build healthy dune systems, it has also helped build community awareness and understanding that coastal hazard management is needed despite the apparent resistance to hazard management planning controls from some sections of the community.

Dougall Gordon
Environment Bay of Plenty
dougall@envbop.govt.nz

Coastal News

Sandy Bits

Horoirangi Marine Reserve Opens

A new marine reserve near Nelson city came into being at the end of 2005. Horoirangi Marine Reserve covers 904 hectares and includes extensive off-shore boulder reefs, which are distinctive of the Boulder Bank, a geologically unique landform of international standing. The marine reserve is the result of a 1999 marine reserve application by the Nelson branch of the Royal Forest and Bird Protection Society.

Coastal Protection Critical To Withstanding Storm Damage

In the wake of yet another devastating hurricane in the US, director of the US Global Water Policy Project Sandra Postel writes in the Christian Science Monitor: "For the same reason people buy home insurance and life insurance – to avoid catastrophic loss – societies need to "buy" disaster insurance by investing in the protection of watersheds, floodplains, and wetlands….We have little time to waste….Global warming and its anticipated effects on the hydrological cycle will make the robustness and resilience of nature's way of mitigating disasters all the more important, as tropical storms, seasonal flooding, and droughts increase in frequency and intensity." To read the complete editorial, go to: www.csmonitor.com/2005/0907/p09s01-coop.html.

EU Launches New Measures To Protect Oceans

Climate change, oil spills and commercial fishing have put oceans and seas at risk, driving the European Union's executive branch to launch new measures to clean up and protect waters surrounding the EU. The measures to protect and conserve the marine environment, guard against the loss of biodiversity, and boost industries that depend on clean water, include requirements that EU member states draw up studies of water conditions as well as targets for improvement and monitoring programs. The EU Commission report said estimates suggest that by 2080, between 13 percent and 25 percent of the world's coastal wetlands could be lost due to sea level rise alone. Tourism would be severely hit by the degradation of marine ecosystems. The proposals include a draft law that would require the EU's 25 member states to work together and draw up plans to protect waters like the Baltic Sea, the North-East Atlantic and the Mediterranean. Further information: http://europa.eu.int/comm/environment/index_en.htm.

Changing Coastal Values

As New Zealanders become more affluent many, together with increasing numbers from overseas, aspire to own property near the coast. The demand for such land has meant that the cost has risen dramatically in recent years. While it might be expected that this will lead to a diminishing pool of potential buyers, people are willing to pay a substantial premium for coastal land and the demand remains high.

Inevitably, this places pressures on local authorities. This not only includes the requirement for new and replacement infrastructure but also the need for proper management of the very resource that created the demand in the first place.

These are not straightforward matters. Although New Zealand still has hundreds of kilometres of unspoiled coastline, there are considerable areas under development or subject to consent applications. Insofar as these tend to be "greenfield" developments, and subject to the rigours of the Resource Management Act 1991 (RMA) as well as council planning policies, it is reasonable to expect they will reflect current wisdom with respect to environmental impacts.

This includes building setbacks, and consideration of the effects on natural character, tangata whenua, coastal processes, heritage, recreation, ecology, and public access, among other things.

Langs Beach in Northland is an example of relatively recent development much of which will have taken place subject to current environmental legislation. One can argue that developments like Langs Beach are elitist and that a beautiful natural beach has been spoiled. While this is not an unreasonable point of view, a case can be made for sensible development and councils have a responsibility to maintain a balance between developed and undeveloped coastline.


Langs Beach

On the other hand, though, there is a legacy from the past that is, in many ways, more problematic and can pose vexing issues for those responsible for coastal management. High on the list is the matter of what to do about existing development, particularly where there is an eroding shoreline. The problem is simple enough to define but the solutions are complex and varied.

Historically, houses were built along the coast at attractive locations. These were often little more than simple baches. Ease of access was also an important consideration and, consequently, early beach settlements were usually relatively close to established urban areas. Many of these, such as St Clair in Dunedin, Sumner in Christchurch, and Mission Bay in Auckland have been absorbed within the urban growth of the city although they originally served as holiday areas for people living in these cities in the early part of last century. The baches, of course, have long since disappeared. There are many examples like this and most now struggle to maintain a viable beach and many are backed by a seawall to protect the development that has taken place from the onslaught of the sea. In some cases, like Scarborough Beach at Sumner where there was once a wide sandy beach, there is now no beach except around low tide.


Scarborough Beach

As the population became more mobile and roads improved, beach development spread further afield but, still, the buildings were mostly relatively simple. Not much was known about erosion and houses close to the shore, if not moved back, sometimes ended up falling into the sea.

This process is still evident today where erosion processes continue unhindered. The problem is that, where once relatively simple housing existed along the coast, sometimes in reasonable harmony with nature, these lands have become so valuable that redevelopment has occurred and the baches have been replaced by expensive homes, often still too close to the sea.

This raises a number of critical issues for councils and may lead to plan changes that involve re-zoning, more restrictive sub-division rules, new construction set-backs, and so on. The RMA has been instrumental in establishing a whole industry around more formal planning procedures on coastal lands and elsewhere. Where there is much less guidance, however, is in the area relating to physical management of the shore including what to do about coastal hazards.

It is not so long ago that the common response to coastal erosion was to build a seawall and often this involved little more than the land-owner dumping whatever could be found along the

beach. This varied from old car bodies to concrete rubble and, sometimes, more substantial structures.

Although many examples of early protection works still exist they were often inadequate, quite apart from their lack of visual appeal. Society generally accepted this along with the consequences since these were not well understood. The loss of the beach was no doubt mourned but landowners felt secure behind a seawall and, after all, there were plenty of other beaches.

This is no longer the case. In these more enlightened times with greater understanding of coastal processes, seawalls, not always justifiably as it happens, receive bad press and there is now a hierarchy of management options for dealing with an eroding coast.

Not that this necessarily makes life any simpler for council staff though as choosing the best solution will probably involve considerable investigation, consultation and, of course, expense.

Space does not allow discussion of coastal management options and this will have to be left for another time. Suffice to say, people are beginning to realize that beaches, aside from a host of recognized attributes, may also make a valuable economic contribution to the community, thus making a strong case for preservation.

After all, more people apparently visit the beaches in Florida in any one year than visit all the national parks in the USA, and this easily justifies the expenditure of millions of dollars on beach renourishment projects.

Perhaps it is not a vain hope that the high value of coastal property in New Zealand, and the undoubted increase in rating revenue thus generated, will encourage councils to direct greater funding towards sustainable coastal management and beach preservation. The potential for a significant return on such expenditure would seem obvious.

John Lumsden, Christchurch
j.lumsden@clear.net.nz

Word from the Chair

As another year starts we are able to look forward to working together as a group of like-minded professionals with an interest in the coastal environment. 2006 is certainly shaping up to be an interesting year with lots of exciting projects and investigations being undertaken around the country and overseas.

The 2006 NZCS Conference preparations are well underway thanks to the Organising Committee capably lead by Justin Cope and Brodie Young at Environment Canterbury. The 2006 Conference will be held from 15-17 November 2006 in Kaikoura. Details will be provided throughout the year but any comments or thoughts are more then welcome to Justin at justinc@crc.govt.nz.

Early preparations are now beginning for the Coastal Society's turn at hosting the Australasian Coasts and Ports Conference 2009. This may seem like years away, however the planning and preparation that goes into this significant event for the society takes considerable work. At this stage the NZCS Management Committee are working on confirming a venue in Wellington and are seeking a Chairperson for the Organising Committee. Any thoughts, comments and volunteers are welcome.

The NZCS Management Committee is focusing on providing support to the Regional Co-ordinators to help them promote the activities of the Coastal Society in the regions – such as support for running local workshops and seminars on current coastal issues.

As you may be aware, the new form of corporate membership was approved at the 2005 AGM held in October at the conference in Tutukaka. We will be promoting the new membership structure to our current corporate members and assisting them through the changes that will come into place in October 2006. We are hopeful of encouraging more corporates to join the Coastal Society. If you would like more information on this please contact David Phizacklea, NZCS Membership Co-ordinator.

It is great to see that *Coastal News* is once again packed with interesting and thought-provoking articles. This newsletter really does provide a great opportunity for the NZCS members to read about what industry people around NZ are involved in and pick up some ideas for their own work. I know the NZCS Management Committee and Editor work hard to bring you new and diverse articles and always welcome contributions.

If you have any comments about the NZCS I would be happy to hear from you directly and am interested in any thoughts from the members. Otherwise I hope you enjoy the new year.

Lucy Brake, Chair
New Zealand Coastal Society
lucy.brake@beca.com

News from the Regions

Northland Region

André LaBonté, Northland Regional Coordinator

The Spirit of Managwhai Dredges Up New Hope for Harbour

The Mangawhai Harbour Restoration Society recently launched their new dredge, *The Spirit of Mangawhai II*. This new and improved ten-inch suction dredge will be used for maintenance dredging of the Mangawhai River channel in the harbour. The dredge may also become available for use in other communities for small channel maintenance and shoreline/beach restoration projects.

Opposition to Sand Mining Still Strong

In April 2005, the Auckland Regional Council declined the applications by Sea-Tow Ltd. and McCallum Brothers Ltd. to continue nearshore sand mining in the Mangawhai-Pakiri Embayment. The applicants appealed the decision to the Environment Court and the case began on the 5th of December, adjourning for the holidays on the 16th of December. It will reconvene on the 7th of February 2006. The appellants' case is being opposed by the ARC as respondent, along with interested (s. 274) parties; Friends of Pakiri Beach, University of Auckland, Northland Regional Council, Kaipara District Council, Rodney District Council, the Mangawhai Harbour Restoration Society, the Mangawhai Heads Volunteer Lifeguard Services, Te Uri O'Hau Settlement Trust, Moko Trust Board, Ngati Manuhiri, the Department of Conservation, Tamarata Residents and Ratepayers Association, NZ Land Trust and Te Uri O'Hau Joint Venture and several individuals.

Marsden Cove Continues to Develop

With the continued fine weather in the area, progress at Hopper Brothers Development at Marsden Cove has continued at pace and is still on target for civil works to be completed by the end of April 2006. Dredging of the access channel is programmed for the period April to September 2006. Tenders have closed for supply and installation of the marina with a condition of tender being that the marina is to be in place and ready for occupation at the same time as the basin is opened to the Whangarei Harbour. Watch this space for notification of the completion party!

Bay Of Plenty Regional News

Aileen Lawrie, Bay Of Plenty Regional Coordinator

Coastal Occupation Charges

Environment Bay of Plenty has recently carried out preliminary public consultation on the prospect of coastal occupation charges for the region.

Most of the coastal marine area (beaches, seabed and sea) is public open space, with an expectation and right by the public to freely use and access most of it. These general rights of public access and navigation have been confirmed in law by the Foreshore and Seabed Act 2004, while the maintenance and enhancement of public access is a matter of national importance under the Resource Management Act 1991. Some activities, like marinas, marine farms, boat sheds, moorings and wharves have rights to privately use parts of the coastal marine area – sometimes exclusively. This is called occupying or occupation. These rights are a form of property right over publicly owned land. Each occupation causes some sort of loss to the public. It could be a loss in visual character, it might limit access, be a navigation hazard or is simply the loss of the ability to use the space for another activity. The level of loss depends on the type of occupation and the degree of exclusivity that the owner has.

The question that Environment Bay of Plenty is facing is: If people occupy public space in the coastal marine area then should those people pay compensation to the community for occupying that space, as they would have to do on land? Most people and businesses who (exclusively) use parts of the coastal marine area don't pay anything for the use of that area, except for some administrative fees that are common to all consents whether they are land or coastal based.

Under the Resource Management Act all regional councils must decide whether or not to introduce coastal occupation charges and, once a decision is made, change their Regional Coastal Plan to show their decision. Regional Coastal Plans set out how that region's coastal marine area is managed. Regional councils are required by law to have one. The Resource Management Act says that when a regional council considers any charging system, the public must be involved in the process.

The law says that the regional council must, on behalf of the public, spend any revenue from coastal occupation charges on the sustainable management of the coastal marine area.

The Council has proposed an initial return from coastal occupation charges of $1M in its draft LTCCP and has asked for public views about whether the income should be used to offset the general rate (with occupation charge income the general rate could be 10% lower than would otherwise be the case) or whether the Council should be considering new projects (and if so what are these).

Responses to the consultation have been varied and complex. Opposition has come from occupiers and some support has come from non-occupiers and interest groups. Many groups indicate a desire to see more action in the coastal area in dealing with water quality, sea lettuce, sedimentation and providing additional facilities.

For more information see www.envbop.govt.nz and click on 'in consultation'.

Tauranga Harbour Integrated Management Review

Environment Bay of Plenty, in conjunction with Western Bay of Plenty District Council and Tauranga City Council has recently completed the Draft Tauranga Harbour Integrated Management Review. The report details the issues that affect Tauranga Harbour, what is currently being done about the issues and what actions need to be taken. The issue of most concern to Tauranga residents, interest groups and professional is that of increased sedimentation. Other pressures on the harbour are those arising from population growth such as wetland losses, seagrass bed depletions, harbour recreation and the exponential spread of mangroves. The report details a number of proposed actions to deal with the issues identified and the major pieces of work likely to result are a detailed sedimentation review and a recreation strategy.

Consultation on the draft was undertaken in December and submissions are currently being received. For more information contact Aileen Lawrie (email Aileen@envbop.govt.nz) or see www.envbop.govt.nz/Coast/TaurangaHarbour/Tauranga-Harbour.asp. A selection of technical environmental reports are also available on the website.

Aquaculture Management Area Planning in the Bay of Plenty

The Bay of Plenty Regional Council's Aquaculture Management Areas (AMA) project, which started in 2002, is nearing completion. Once complete it will identify opportunities for AMAs based on a detailed picture of the social values and physical parameters of the Bay of Plenty coastal marine area.

The social values are being determined by "Offshore Use Maps". These maps will show the uses and values in the coastal marine area such as navigation, recreational fishing and cultural sites. Draft versions of the maps are currently going through public consultation, with the final day for comments being 24 February 2006.

The "Offshore Science Project" is looking at the physical parameters and has included field surveys of water chemistry, phytoplankton concentrations and, sediment characteristics. It is anticipated that the Offshore Science Project will be finalised by May 2006.

For more information contact Ben Lee (email benl@envbop.govt.nz) or check out the website and click on 'in consultation'.

Ohiwa Strategy

Environment Bay of Plenty is in the process of finalising a draft strategy for the Ohiwa Harbour and catchment. The document is designed to formalise the working partnership that has developed for resource management issues involving the Ohiwa Harbour. Environment Bay of Plenty is "holding the pen" on behalf of Opotiki District Council, Whakatane District Council and the tangata whenua (Upokorehe, Whakatohea, Ngati Awa and Tuhoe). The process has involved extensive public consultation and working parties with government agencies.

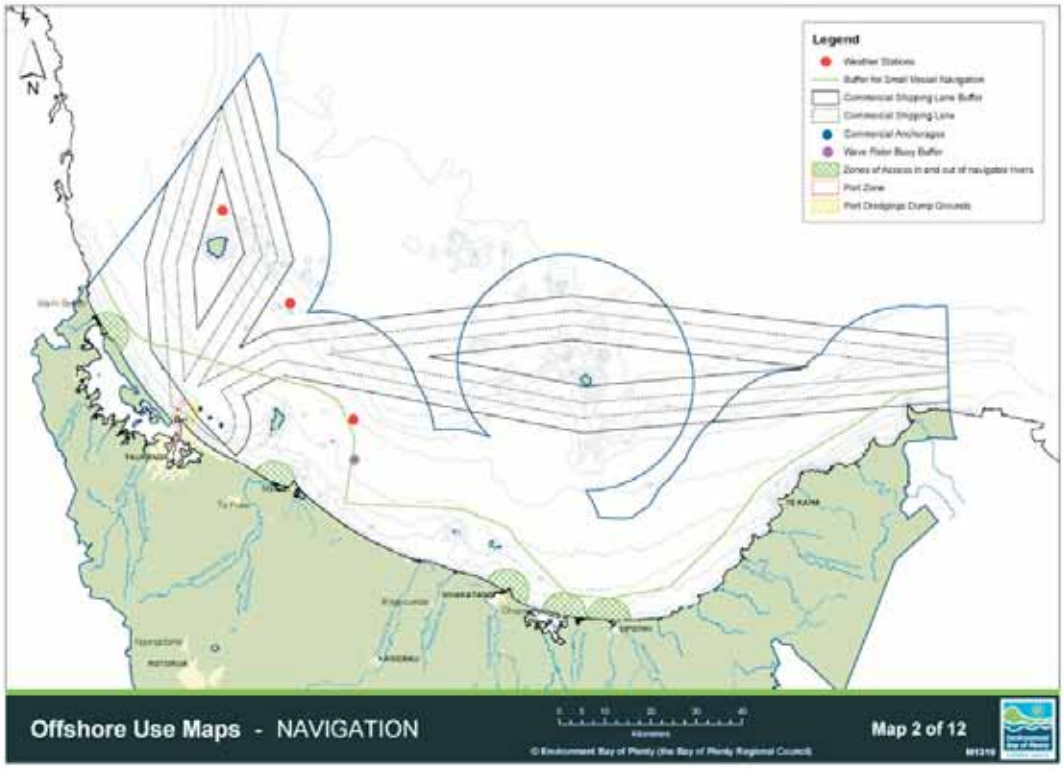


Figure 1: An example of the Draft Offshore Use maps

The aim is to adopt a set of policies for the harbour and an action plan to address the large number of issues that were identified by the community (such as sedimentation, mangrove spread and a lack of information to manage perceptions about the Harbour).

Every step has involved considering how integrated management for the harbour can be achieved. Two key issues have been at the core of the strategy: providing for kaitiakitanga, and addressing the pressure for subdivision and development around the harbour margin. In relation to the first issue, an iwi planning document has been developed that addresses consultation and the provision of advice for resource management matters.

The issue of development pressure has led to the identification of actions to evaluate district and regional plans to ensure planning provisions are consistent and consistently applied across the whole harbour.

For more information contact Stephen Lamb (e-mail: Stephenl@envbop.govt.nz).

Wellington Region

David Kennedy, Wellington Regional Coordinator

Naval Frigate Sinks Off the Wellington Coast

The most exciting event on the Wellington coast in the last few months has been the sinking of the New Zealand Naval frigate *HMNZS Wellington* on the south coast as a dive attraction in mid November. The ship lies in 20m water depth in the marine reserve off Island Bay and has proven to be a huge success with local divers flocking to the area. The ship is a Leader Class Frigate and was commissioned as the *HMS Bacchante* to the Royal Navy in 1969 where it served in the North Atlantic during the Cold War. It was then commissioned to the NZ Navy from 1982 until 1999. The SINKF69 trust subsequently bought it for the princely sum of $1 with the aim of creating a world class dive attraction in the city that bears its name. It has proved a very popular attraction with hundreds of divers visiting the wreck within a month of its sinking. For more information about the ship and some great photos of its sinking log onto www.divewreck.co.nz/F69/

Blue Flag flies high at Westhaven Marina

Westhaven Marina, the largest in the Southern Hemisphere, recently became the first marina or beach in New Zealand to be awarded the Blue Flag eco-label in recognition of its efforts towards environmental education and management.

The Blue Flag is an exclusive eco-label currently awarded to around 3100 beaches and marinas in 35 countries across Europe, South Africa, Canada and the Caribbean.
The Blue Flag Campaign is owned and run by the independent non-profit organisation Foundation for Environmental Education (FEE).
The Blue Flag works towards sustainable development at beaches and marinas through strict criteria dealing with water quality, environmental education and information, environmental management, safety and other services. The Blue Flag Campaign includes environmental education and information for the public, decision makers and tourism operators.

Photo 1: Erin Alley, Blue Flag, and Kyla Brookes, Westhaven Marina, with an esteemed blue flag.

History

The Blue Flag was born in France in 1985 where the first French coastal municipalities were awarded the Blue Flag on the basis of criteria covering sewage treatment and bathing water quality.

In 1987 the French concept of the Blue Flag was developed on a European level to include other areas of environmental management, such as waste management and coastal planning and protection. Besides beaches, marinas also became eligible for the Blue Flag at that time. As a result the organisation known as FEEE (Foundation for Environmental Education in Europe) was formed.
By 2001 the developers of the Blue Flag concept had decided to become a global organisation and consequently changed their name from FEEE to FEE.

Several organisations and authorities outside Europe have made applications to FEE, wishing for co-operation on spreading the Blue Flag Campaign to non-European countries. FEE has been co-operating with UNEP and WTO on extending the Campaign to areas outside Europe. The Blue Flag Campaign has already been implemented in the Republic of South Africa, Canada, Morocco, New Zealand and in four countries in the Caribbean region. Chile is currently in the pilot phase of the campaign and interest has also been expressed by the USA, Argentina, Brazil, Ecuador, the United Arab Emirates and countries in South East Africa.

It's Official

The Mayor of Auckland, Dick Hubbard, along with Marina Manager, Keith Hogan, raised the flag in a brief ceremony at Westhaven Marina on November 19 2005 to mark the official awarding of the Blue Flag honour.

"Being awarded this country's first Blue Flag is evidence that we take our environment seriously. Good environmental management is a normal part of our operating practice. We see Blue Flag as recognition of our achievements, and it is also a daily reminder of our role in educating a wider group of Westhaven users," said Westhaven Marina Manager, Keith Hogan.

"Obviously it doesn't stop here, the commitment we have made to Blue Flag and our stakeholders will be evident in the future as we continue to improve on the high standards we have set ourselves."

As key users of our coastal waters, recreational boat owners greatly appreciate the natural beauty and environmental qualities of New Zealand's ocean and are therefore encouraged to keep the coastal water clean through the Blue Flag programme. Blue Flag serves both to recognise and promote further environmentally friendly practices.

Kyla Brookes, Westhaven Marina
kyla@westhaven.co.nz
www.westhaven.co.nz

Photo 2: The Mayor of Auckland, Dick Hubbard, and Marina Manager, Keith Hogan, raise the flag in a brief ceremony at Westhaven Marina.

Wet Bits

The international focus for World Wetlands Day 2006 was the role of wetlands in supporting life and sustaining livelihoods. In numerous ways, wetlands are vital lifelines, however the important role they play is not always recognised or respected.

Re-creating Rare Waikato Wetland Ecosystems

A new project aims to re-create two threatened giant jointed rush (Sporadanthus ferrugineus) wetlands, one each in the Waikato and Waipa districts, which will be open to the public. The wetland ecosystems will be re-created by transferring seeds and plants from the few remaining habitats. The project will also raise public understanding of the ecological importance and beauty of this rare wetland type, which once covered vast tracts of the Waikato region but is now limited to three sites.

Ministry for the Environment is the key funder, giving $105,000 from its Sustainable Management Fund for the project's first year with contributions from NZ Landcare Trust, Environment Waikato, Waikato District Council and Waipa District Council. A recently-published brochure on the project can be viewed at www.landcare.org.nz/lctdatabases/knowledgeman/pdfs/p825.pdf.

Another part of the project involves developing a Community Wetland Restoration Projects Database. 'Community Wetland Restoration Projects: Lessons Learnt' gives some tips provided by communities working on 20 diverse wetland projects throughout New Zealand - see www.landcare.co.nz/policies/files5007/Wetland%20restoration_Lessons%20Learnt.doc. A further 24 community wetland projects are being followed up.

New Wetlands Website

The Coastal CRC Wetlands Web Portal www.coastal.crc.org.au/wetlands/index.html has a list of current wetland research an extensive links page covering information about wetlands and a conceptual diagram of wetlands reclamation.

Report Urges Action To Protect Wetlands

The Great Barrier Reef Marine Park Authority has released a new report detailing the relationship between wetlands and fish stocks on the Great Barrier Reef. The report has made a number of recommendations, including the mapping and inventory of wetlands resources, supporting on-ground actions to conserve and manage wetlands, and protection of remaining wetland areas. The report will assist regional Natural Resource Management Boards to prioritise on-ground actions for wetland protection and maintenance in the Great Barrier Reef catchment, which is one of the key strategies in the Reef Water Quality Protection Plan. It identifies the dependence that over 70 species of fish have on both marine and freshwater environments. Download the report at: www.gbrmpa.gov.au/corp_site/key_issues/water_quality/wetlands.html#Freshwater. For information contact: Vern Veitch at Sunfish, phone 0418 729 496 or Karen Vohland at GBRMPA, phone 07 4750 0737. Related site: 'The Wetlands Policy of the Commonwealth Government of Australia' www.deh.gov.au/water/wetlands/publications/policy.html.

Revive Our Wetlands

Revive our Wetlands is the largest national wetlands revival program in Australia established by Conservation Volunteers Australia and BHP Billiton. Between 2000 and 2003 $1.5 million of funding assistance, and more than 17,000 volunteer days, have contributed to the revitalisation of 100 of Australia's most significant wetlands. Until 2006 the project will see an additional $1.5 million and 15,000 volunteer days invested at 10 priority locations across remote, regional and urban Australia. The project won the Financial Review Magazine's Corporate Partnership of the Year Award. Visit: www.reviveourwetlands.net/revive/.

Urbanisation Index To Help Protect Coastal Wetlands

An index of 'hard' developed surface areas may become a guide for urban planners to protect the quality of coastal wetlands. The 'urbanisation index', measured as a percentage of impervious surfaces such as roads, buildings and car parks in a catchment, is being developed by Coastal CRC to assess the impacts of urban development on wetlands. At this stage, it appears that if more than 10% of a catchment is covered by impervious surfaces there will be a marked deterioration in wetland ecosystem structure and function due to pollution from stormwater run-off and other disturbances associated with urban development.

Busselton Wetlands Management Strategy

A conservation and land-use strategy for Western Australia's Busselton wetlands has been launched after six years of extended planning and community consultation. The wetlands are home to tens of thousands of waterbirds, including a large breeding colony of the state's emblem, the black swan. Under the new plan, sustainable agricultural land use considered beneficial to the wetlands will be promoted and existing broad-acre farming near the wetlands can continue, but no further clearing of native vegetation for agricultural purposes will be supported. Most of the wetlands are listed under the Ramsar Convention for Wetlands of International Importance. The Busselton Wetlands Conservation Strategy is available at the WA Planning Commission's website:

News from the UK

Regulation of UK Offshore Windfarms

The development of renewable energy in the marine environment has been a challenge since day one. The offshore wind industry tested a new regulatory framework that required cross-departmental assessment and based assessments of environmental impact primarily on predicted risk. Stacey Faire, Adrian Judd, Jon Rees and Piers Larcombe of Cefas provide a brief overview of the drivers, regulatory framework and assessment tools, and describes some lessons learnt from the development of the Scroby Sands Offshore Wind Farm (OWF).

Drivers

From the outset, the regulators recognised that new approaches were required to meet the new challenges presented by the new offshore industry. The regulators responded with three key actions:

- Developing guidance for developers preparing Environmental Impact Assessments (EIAs);
- Identifying gaps in knowledge and, with other government departments, commissioning appropriate scientific research and development projects;
- Requiring environmental advisors to apply adaptive management tools to link predictions with monitoring results.

The United Kingdom has the fastest growing renewable energy sector in Europe. To date, there are three OWFs generating up to 124 MW of electricity (Scroby Sands, North Hoyle and Blyth Offshore). There are a further 15 projects awarded and in the early stages of planning, which will amount to a generation capacity of 7.2 GW, potentially contributing electricity to more than 4 million households. As described in the Energy White Paper, the rapid development of OWFs is the UK government's response to reach renewable energy targets of 10 per cent of the UK generation capacity by 2010 and 20% by 2020. Tidal energy is also under consideration around the UK, with a trial tidal device installed off Lynmouth, Devon since May 2003, which generates 0.3 MW of power, and a pilot scheme recently approved for Strangford Lough, Northern Ireland, which is designed to generate up to 1 MW. Monitoring of these projects should provide valuable data for other regulators and developers. To date, Scotland has one OWF (Robin Rig) and have established a demonstration area for industry to test wave and tidal energy technologies.

Regulatory Framework

When these projects were being initiated, the regulatory framework for offshore developments was highly complex, with a large degree of overlap in regulatory powers across a variety of government departments. For England and Wales, the government response to this complexity was to streamline the system, by having one government department to co-ordinate the technical evaluation of proposed developments. The process is different for the devolved administrations of Northern Ireland and Scotland.

The development of OWFs commenced with a demonstration round (Round 1), allocated and managed by The Crown Estate, which owns virtually the entire seabed out to the 12 nautical mile territorial limit, and which licences the generation of renewable energy on the continental shelf out to 200 nautical miles. Round 1 included 14 OWFs that together are estimated to account for 24 % of the world's renewable energy projects. The process started with the allocation of seabed through a tendering procedure. This allocation is primarily a contractual agreement between the seabed owner and the developer and does not have any influence over the environmental assessment process. The proposals of Round 2, announced in December 2003, are significantly larger in scale, with proposed areas to include up to 270 turbines per site (compared to the Round 1 average of 30) with each project involving fifteen sites for development. representing 5.4 - 7.2 GW of power.

Environmental Impact Assessment

The UK government has a commitment to meet various energy-efficiency targets and the evaluation process for renewable energy developments has used risk assessment tools and has relied on adaptive management techniques. This continuous-learning process has required close relationships between all stakeholders. In particular, it has required regular liaison with developers, to ensure that sound baseline surveys are completed in order to allow later assessment of predicted impacts against measured impacts.

Most European countries have applied a precautionary approach to the development of OWFs. This approach generally requires the holding of public inquiries, which includes local community participation and open debate about site selection and environmental impacts. There is often an extended period between developments which enables the interpretation of data produced by monitoring programs to inform the next stage of proposed development.

In England and Wales, the approach has been to use lessons from other relevant industries to determine the potential likelihood of environmental impacts from OWFs. This process has drawn on experiences of the telecommunications, cable-laying and maritime construction industries. Transferable experience includes knowledge of material impact, avoiding sensitive seasonal periods, using soft-starting techniques when pile-driving to reduce noise impacts and, to some extent, construction techniques. However, OWFs bring new potential impacts such as electromagnetic fields, altered

Figure 1: Scale of the structures

- *Tower Height ~ 70 m above mean sea level*
- *Blade diameter ~ 80 m*
- *Monopile ~ 5 m diameter*
- *Gravity Base ~ 30 m diameter*
- *Piling noise <260 dB*
- *Pre-fabricated sections*
- *Installation of ~1 day, with completion in 3 – 4 days*
- *Minimum of 370 m spacing between turbines.*

sediment transport regimes and barrier effects to birds and bats. These gaps in knowledge are being addressed through practical research initiatives that will prove very useful, but some of which, by their nature, will take time to deliver evidence through to policymakers and regulators.

Scroby Sands OWF

Cefas were commissioned to complete monitoring of one of the Round 1 OWFs, the site of Scroby Sands, located 3 km to the east of Great Yarmouth, Norfolk, on the East Coast of England. The monitoring was designed to gather evidence regarding potential hydrodynamic and sedimentary impacts, specifically:

1) To evaluate modelling predictions presented in the environmental impact statements by the developers, and;
2) To investigate whether the turbines had any combined impacts and;
3) To recommended future R&D requirements.

Scroby Sands sandbank is comprised of three segments, North, Middle and South Scroby Sand (with Corton Sands lying to the South), with swales between them. The bank is aligned N-S, parallel to the coastline, and runs from Great Yarmouth to a point between Winterton-on-Sea and Hemsby. Overall, the sandbank is 12 km in length, varies between 0.5 and 2.5 km in width, has an average water depth of 6-12 m and some areas which are exposed at low tide. The site is subject to strong tidal currents of up to 1 m/s and waves dominantly from the NE.

Since June 2005, the site has hosted 30 turbines that penetrate the seabed to an average depth of 30 m and have a pile diameter of 4.2 m at the seabed. There are a total of 26 km of connecting electrical cables. Cables enter each monopile through j-shaped tubes around 30 cm in diameter, which have their open ends buried beneath the sand.

Data gathered

Pre-construction data gathering provided a physical baseline model to compare the construction and operation phases of the project. The monitoring programme included deployment of instruments on the seabed, where Cefas 'Mini-Landers' recorded current profiles, wave statistics and turbidity. Six monthly surveys using side-scan sonar and 100% coverage using swath-bathymetry provided high-quality digital elevation models which allowed changes in bed elevation to be quantified.

What the issues are for the site?

One of the predicted impacts at Scroby Sands was the generation of significant scour features associated with the monopiles. Scour pits up to 5 m deep have been observed, and larger areas of lowered topography ('tails') extend away from some scour pits. One of the objectives was to investigate the extent of the scour pits and tails to determine whether they interacted with features generated at adjacent monopiles and whether there was a demonstrated physical impact on the sediment transport patterns over the sandbank.

What did the data tell us?

To date, over a 2-year period, four surveys have been completed at 6-month intervals, and there has been no overall significant change in sandbank morphology. Between surveys, changes in sediment volume of the entire sandbank have been 100,000 - 400,000 m3. The surveys demonstrate the excavation of approximately 5,000 m3 for a typical scour pit and of 5-25,000 m3 from each of the sediment tails, although these occur on relatively few monopiles. The present data indicate that there are no significant changes to the overall sedimentary regime of the sandbank related to the presence of the OWF, but the time-series is brief, and there are some aspects that require ongoing monitoring.

What are the lessons for other windfarm sites?

Many of the Round 1 and 2 OWFs are situated on sandbanks comprising mobile sandy

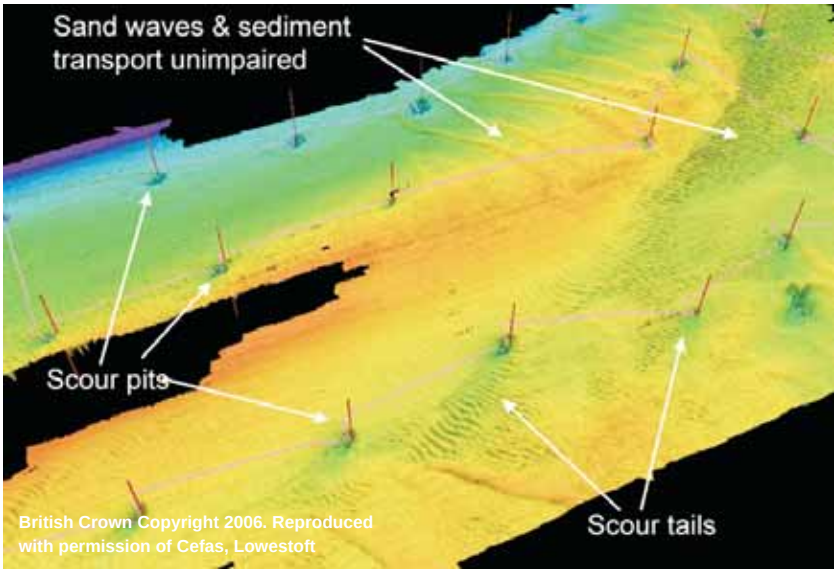


Figure 2: Seabed around the turbines

sediments, and thus the intra-array cable routes are subject to significant sediment transport issues. Scour occurs around cables, bedform migration may result in free-spans in the cables across bedform troughs, and cables may be liable to vibration where the cable is exposed at the seabed, near the j-tube opening. The power export cable also has to cross areas that would normally be avoided by cable operators because of the strong currents and fields of mobile sandwaves. In some locations, on the East Coast, export cables also have to traverse areas of chalk, requiring larger ploughs and hence potential for impacts from chalky turbid plumes.

Lessons learnt

Useful lessons from comparable impacts can be taken from the experiences of other industries. As discussed above, such lessons are mainly mitigation measures, which are designed to avoid sensitive periods of fish spawning or reduce impacts of noise on marine mammals. Nonetheless, there still are unanswered questions that require additional evidence to be gathered, assessed and reported to regulators and policymakers for implementing in decision making. Key challenges include understanding the impacts of electromagnetic fields, the significance of noise impacts and the barrier effects of OWFs to birds and bats. The proposed Round 2 OWF's will require improved understanding of sediment transport, particularly because of the significantly larger and more complex structures which are being considered as turbine foundations, including tripods and gravity-based structures. Whilst practitioners throughout Europe are sharing relevant knowledge, there are inevitable time lags between construction, operation and the generation of long-term monitoring data related to OWFs, so that some of the lessons may not become apparent for some time to come.

At present, OWFs require a subsidy from the UK government for electricity companies to buy the energy they generate. The Energy White Paper supports the development of renewable energy sources, but also recommends the need for substantial investment in energy efficiency and exploration of other low-carbon energy options. There are good opportunities across Europe for countries to continue to learn from one another regarding the options for renewable energy development. Whatever mix of options is selected by various countries, they need to be fit for purpose and to support the over-riding aim of encouraging a sustainable low carbon economy.

If you will like an more information about the regulatory assessment of OWF developments please feel free to use the weblinks below or email Stacey Faire s.o.faire@cefas.co.uk or Adrian Judd a.judd@cefas.co.uk.

Weblinks

The Centre for Environment, Fisheries and Aquaculture Science
www.cefas.co.uk/renewables/Default.htm

Defra Sustainable Energy website
www.defra.gov.uk/environment/energy/index.htm

DTI Strategic Environmental Assessment on offshore wind farm development
www.og.dti.gov.uk/offshore-wind-sea/process/envreport.htm

Crown Estate Wind Farms Website
www.crownestate.co.uk/estates/marine/windfarms.shtml

British Wind Energy Association - Offshore wind farms website
www.offshorewindfarms.co.uk

All-Energy Electronic news letter and website
www.all-energy.co.uk/news.php

Stingray project - Tidal energy generation
www.engb.com

Chamber of Shipping view of windfarms
www.british-shipping.org/news/windfarms/wind_farms overview.htm

Conferences and Workshops

Community Participation in Coastal Hazard Mitigation

26 April, 2006, Wellington, NZ.

A one day workshop on community participation in coastal hazard mitigation will be aimed at local authorities who interact with community groups on coastal issues.

The workshop will explore the interactions between stakeholders, technical experts and regulatory authorities in managing coastal hazards, using a series of case studies and experiences brought to the workshop by participants.

This will lead to an analysis and identification of what drives 'good' versus 'bad' outcomes and how community groups can be best empowered to address coastal hazards through informed choice.

For more information contact Julia Becker, j.becker@gns.cri.nz, 04 570 4795, or Terry Hume, t.hume@niwa.co.nz, 07 856 1729.

Coast to Coast 2006: Australia's National Coastal Conference

May 22-25, 2006 Melbourne, Australia.

Australia's biennial national coastal conference will focus debate across a full range of coastal and marine issues including the need for sustainable coastal and marine use, planning and management regarding increasing natural disasters, higher demand to live on the coast, more certainty in climate change research, continuous battles with weeds, new marine pests, and dwindling fish populations.

For more information visit www.iceaustralia.com/coasttocoast2006/.

Coastal Zone Asia Pacific 2006

August 29-September 2, 2006, Batam Island, Kepulauan Riau Province, Indonesia (near Singapore)

This international conference aims to review the state of coastal management in the Asia-Pacific region.

Themes of the conference are tsunami rehabilitation and reconstruction, the state of coral reef management, coastal fishing and community empowerment, marine conservation and MPA networks, sea partnership and policy, small island management, and coastal and ocean governance.

For further information contact: Sapta Putra czap06@dkp.go.id or visit www.coastal.crc.org.au/czap04

International Coastal Symposium

April 16-20, 2007, Gold Coast, Queensland , Australia.

ICS2007 will bring together coastal scientists, managers, planners and engineers from around the world to discuss issues and activities relating to the coastal region.

The ICS2007 Organising Committee invites you to submit an abstract using the details found on www.griffith.edu.au/school/eng/ics2007

The ICS2007 proceedings will be published in a special issue of the *Journal of Coastal Research*.

For further information please visit the ICS2007 WWW site and/or contact ICS2007@griffith.edu.au.

NZCS Regional Coordinators

Every region in the country has a NZCS Regional Coordinator who is available to help you with any queries about NZCS activities or coastal issues in your local area.

North Island

Northland	André Labonté	labonte@xtra.co.nz
Auckland	Scott Nichol	s.nichol@auckland.ac.nz
Waikato	Jenni Fitzgerald	jennifer.fitzgerald@ew.govt.nz
Bay of Plenty	Aileen Lawrie	aileen@envbop.govt.nz
Hawkes Bay	Gary Clode	garyc@hbrc.govt.nz
Taranaki	Peter Atkinson	dwk.newplymouth@duffillwatts.com
Manawatu/Wanganui	Johanna Rosier	d.j.rosier@massey.ac.nz
Wellington	David Kennedy	david.kennedy@vuw.ac.nz

South Island

Upper South Island	Eric Verstappen	eric.verstappen@tdc.govt.nz
Canterbury	Justin Cope	justin.cope@ecan.govt.nz
Otago	Mike Hilton	mjh@geography.otago.ac.nz
	Paul Pope	poppa185@student.otago.ac.nz or popey@xtra.co.nz
Southland	Ken Murray	kmurray@doc.govt.nz

Undaria pinnatifida Investigation in Tauranga Harbour

Coastal News

Keith Gregor reports on a preliminary survey for Japanese kelp (Undaria pinnatifida) in Tauranga Harbour conducted for Environment Bay of Plenty by the Marine Studies Department of the Bay of Plenty Polytechnic.

Japanese kelp is a highly invasive laminarian kelp, indigenous to the temperate regions of Japan, China and Korea that has spread to many locations around the world, including New Zealand, via international shipping.

It was first detected in New Zealand in Wellington Harbour in 1987 and concerns have been raised about the possible impacts of *Undaria* on New Zealand marine biota following its spread to a variety of areas around the country. Although the kelp, known as wakame, has been used as a food dish for centuries and forms the basis of a thriving aquaculture business in Japan it is listed as an unwanted organism under the Biosecurity Act, 1993 in New Zealand.

After reports of *Undaria* plants at the mouth of the Tauranga Harbour in November 2005, subtidal surveys were conducted by the Bay of Plenty Polytechnic Marine Studies department, during December 2005, in collaboration with Environment Bay of Plenty.

The survey confirmed the presence of *Undaria* at

Photo 1: A mature Undaria pinnatifida can easily by distinguished from NZ native kelps by the presence of the frilly sporophyll (spore producing structure) on the stipe, the presence of a pronounced central midrib and divided fronds in the mature specimens.

Photo 2: Mature Undaria sporophyte showing frilly sporophyll (spore bearing structure).

Pilot Bay Reef at a depth of between 5 and 10 metres with no plants found deeper than 11.5 metres. *Undaria* was not found on the rocky substratum but chiefly found attached to tubeworm cases or on shell debris and was easily dislodged from the substratum. A range of plant sizes was recorded from 60mm to just over 800mm. The *Undaria* plants were scattered but two beds of approximately $2m^2$ and $4m^2$ were recorded within the entire survey area. A range of samples were taken and preserved in isopropyl alcohol for future analysis. No *Undaria* was recorded on any buoyage, the pier or marina protection walls.

Collaborative work is now underway with Environment Bay of Plenty and the Marine Studies Department to extend the survey area to ascertain whether *Undaria* is present at other sites in the harbour or open coast. An action plan is also being drafted to respond to the presence of the invasive seaweed with a range of actions being considered from eradication to regular monitoring.

For more information contact Keith Gregor, Marine Studies Department, Bay of Plenty

Photo 3: Bay of Plenty Polytechnic survey divers surfacing with specimens of Undaria pinnatifida.